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First Detection of Methanol in Protostellar Disks

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We report the first detection of emission from gas phase methanol in a protostellar disk in the young, class 0 infrared source located in L1157. Spatially unresolved emission was detected in the 2$_k$-1$_k$ transitions of methanol at 3mm using the Caltech Owens Valley Millimeter Array. The fractional abundance of methanol is about 2 x 10^{-8} in the flat disk model, and 3 x 10^{-7} for a flared disk. The fractional abundance is small in the disk as a whole, but considerably larger in the warm portions. This difference indicates that substantial chemical processing probably takes place in the disk via depletion and desorption from grains. The methanol desorbed from the grains in the warm surface layers returns to the icy grain mantles in the cooler interior of the disk, where it is available to become part of the composition of solar system-like bodies, such as comets, formed in the outer circumstellar region. This first millimeter--wavelength detection of a complex organic molecule in a young protostellar disk has implications for disk structure and chemical evolution and for potential use as a gas and dust temperature probe.

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